DOCUMENT RESUME

ED 292 807 SP 030 162

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TITLE The Social Construction of Biological Knowledge.
PUB DATE Apr 87
NOTE 18p.; Paper presented at the National Convention of the American Alliance for Health, Physical Education, Recreation and Dance (Las Vegas, NV, April 13-17, 1987). Document may not reproduce well.
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Brain Hemisphere Functions; Curriculum Development; *Data Interpretation; Health Education; Information Dissemination; *Physical Education; *Research Utilization; Sex Differences; *Social Values
IDENTIFIERS *Health Promotion

ABSTRACT

The influence of biological science research on the development of physical education curriculum is examined in this paper. The social construction of scientific knowledge is described as occurring in the selection of problems to be studied, the collection and interpretation of data, the dissemination of results, and the educational uses of knowledge. Each of these aspects of the social contruction of biological knowledge as they apply to physical education is examined. Two topics serve as examples of the relationship between biological science research and physical education curriculum: mind-body dualism, and sex differences in performance. The significance of recent research on cerebral hemispheres for understanding of the movement experience is cited as one example. As the second example, the risk that research on gender differences in performance may reinforce the ideology of male superiority is pointed out. In considering the dissemination and application of knowledge, the question is raised of the dangers implicit in the sometimes fallacious interpretation of research on obesity being disseminated as fact in some health promotion endeavors. (JD)

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The Social Construction of Biological Knowledge

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Paper presented at the Annual Convention of the American Alliance for Health, Physical Education, Recreation and Dance, Las Vegas, April, 1987.

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Thomas Kuhn (1962) has described science in terms of scientific communities in which a shared paradigm defines problems, methods and standards of solution. Today I come as a stranger to visit the community of biological scientists. Like any visitor, I find the language and the customs unfamiliar and exotic and somewhat intimidating. Nevertheless, I am proceeding with my journey because your world and mine interact in some very important ways.

My world is physical education curriculum design. I am concerned with the development and implementation of physical education programs for children and adults. As a curriculum theorist, I am particularly interested in the questions of what should we teach and why. My interest in the biological sciences relates to the influence such science has on physical education program development.

My presentation is entitled "The social construction of biological knowledge". The perspective I will take is based on two fundamental assumptions:

1. All knowledge, including scientific knowledge, is socially constructed.
2. Research is a value-based not a value-free activity.

I will begin with a brief rationale for these assumptions and then proceed to examine the social construction of biological knowledge as it relates to physical education.

Social Construction of Knowledge

In his classic book, The Structure of Scientific Revolutions, Kuhn (1962) suggests that the paradigms which give form to scientific life have a normative as well as a cognitive component. The paradigm not only prescribes research methods and standards but also defines which problems are worthy of study:

> Since no two paradigms leave all the same problems unsolved, paradigm debates always involve the question: Which problems is it more significant to have solved? (Kuhn, 1962:110)

Thus, the selection and framing of the research problem is not a value-free process but is derived from a view of reality negotiated by a particular scientific community at a particular point in history.

The scientist's paradigmatic assumptions influence not only the selection of the problem but the data collection process itself. Kuhn (1962: 111) suggests that "paradigm changes do cause scientists to see the world of their research-engagement differently". Polanyi (1966:20) proposes that "tacit knowing" underlies all observation and forms an indispensable part of all knowledge. Foucalt (1975) describes how two physicians separated by less than a century literally saw entirely different things when they examined the anatomical structures of the brain. These authors suggest that not just the scientist's interpretations of data but his very perceptions of data are influenced by tacit assumptions and beliefs.

The social construction of scientific knowledge is not limited to the scientific process itself. The dissemination and application of information also are value-laden processes. Decisions regarding the

publication of scientific manuscripts are based on the definitions of standards and quality that are inherent in the paradigm endorsed by the editorial board. Research that challenges the paradigm will likely not be published and if published may be disregarded or dismissed as an anomaly by scientists operating within the dominant paradigm. The struggle for paradigmatic change is a social struggle over the definition of legitimate knowledge.

The struggle to define legitimate knowledge is particularly evident in educational institutions. Basil Bernstein (1975:85) states:

> How a society selects, classifies, distributes, transmits and evaluates the educational knowledge it considers to be public, reflects both the distribution of power and the principles of social control.

The social construction of knowledge in educational settings occurs initially in the selection and organization of curricular content. But it also exists in the negotiations of meaning that occur in face-to-face interactions among teachers and students (Berger & Luckmann 1966).

The social construction of scientific knowledge occurs in the selection of problems to be studied, the collection and interpretation of data, the dissemination of results, and the educational uses of knowledge. Our next task is to examine each of these aspects of the social construction of biological knowledge in physical education.

Biological Knowledge and Physical Education

I will not attempt a comprehensive review of paradigms and issues in biological research but will describe examples that seem to illustrate the social construction of knowledge. My examples will relate to the creation of knowledge as well as its dissemination and application. However, my analysis of the former must of necessity be limited by my status as outsider rather than insider in the biological scientific community.

To examine the research process itself, I have selected two topics that have relevance to my personal value system and work: mind-body dualism and sex differences in performance. In general, physical education researchers have studied the body as a machine and the mind as a computer. Such work reinforces a dualistic separation of mind and body and tends to contradict the lived experience of movement as a form of "embodied consciousness" (Arnold, 1979). John Searle, in Minds, Brains and Science (1984), has presented a cogent argument for viewing consciousness and intentionality as integral to the study of the brain and of human action. Roger Sperry (1982), the recipient of the 1981 Nobel Prize in Medicine for his research on cerebral hemispheres, indicates that an indirect result of split-brain research is a revised concept of the nature of consciousness and its fundamental relation to brain processing. He states that:

> The whole world of inner experience (the world of the humanities), long rejected by 20th-century scientific materialism, thus becomes recognized and included within the domain of science. Basic

> revisions in concepts of causality are involved, in which the whole, besides being "different from and greater than the sum of the parts," also causally determines the fate of the parts, without interfering with the physical or chemical laws of the subentities at their own level.

The fundamental paradigm shift implied by the work of Searle and Sperry and others has significant implications for physical education. Although I cannot specify the precise ways in which your research might be altered, a science that recognizes the holistic nature of human existence could have profound effects on our understanding of the movement experience.

My second example of the social construction of knowledge in the research process is the topic of sex differences in performance. Paul Willis (1982: 119) states that:

> ...many of the approaches to women in sport exhibit the clearest aspects of positivism in contemporary social research. They share an assumed deterministic model, isolated from the general culture, composed of dependent and independent variables.

Willis suggests two fundamental problems with research on sex differences in performance. First, the cultural meaning of the phenomenon is either ignored or dealt with in simplistic linear fashion. Second, little attention is given to why some differences but not others are viewed as important. For example, he asks why differences in strength are seen as important while differences in flexibility often are not?

As biological scientists, you may argue that cultural issues are irrelevant to your work. Yet you make decisions about the measures on which you will compare men and women based on cultural definitions of skillful performance. Decisions are also influenced by a paradigmatic bias in favor of studying differences rather than similarities. (We even label similarities as non-significant differences!) Although some scholars such as Christine Wells (1985) discuss both similarities and differences, much of the literature focuses on differences.

There are also methodological questions to be faced. Research that restricts explanations of performance differences to biological variables has limited explanatory power and may reinforce the belief that performance is unaffected by environmental factors. However, research that attempts to add cultural variables to a biological model does an injustice to the complexity of culture and experience. For example, a recent study of biological and environmental influences on gender differences in throwing performance used the following as measures of environmental factors: whether the child had older brother(s), older sister(s), adult male(s) in the home and whether the child played with other children (Nelson, J.K., Thomas, J.R., Nelson, K.R. & Abraham, P.C., 1986). Despite the well-intentioned efforts of these researchers to examine sociocultural as well as biological influences on performance, the conceptualization of environment within a linear positivist model did a disservice to our understanding of cultural definitions of gender and their relationship to performance.

The risk is that research on sex differences in performance will serve to reinforce the ideology of male superiority unless the work is framed and interpreted in a broader cultural context. Numerous instances of the use of science to support ideology can be cited. For an example related to women and performance, read Patricia Vertinsky's (in press) excellent historical analysis, "Exercise, Physical Capability and the Eternally Wounded Woman in Late 19th Century North America" which is to appear in the spring 1987 issue of the Journal of Sport History. Vertinsky describes how medical practicioners used "scientific evidence" about the effects of menstruation on women's physical capabilities to control the life choices of middle class women and set limits on their activities. Although some will argue that this historical analysis is not really applicable to today, it should be noted that the 1984 Olympics was the first to include a women's marathon.

At this point, let us turn our attention from issues related to the generation of knowledge to the dissemination and application of knowledge. For this analysis, I would like to focus on the topic of health promotion and to examine the ways in which research linking behaviors to health status is interpreted and applied. How should research indicating that smoking causes cancer or that exercise and obesity are risk factors for heart disease be disseminated and applied? What are the implications for public policy and for educational policy? What is the role of the scientist in determining such policy?

Health promotion is a complex social and moral issue. One concern is that focusing primarily on personal behavior as the means to good health may ignore environmental factors that are beyond the control of the individual. Alan Ingham (1985:54) has questioned both the ethics and the effectiveness of this approach, saying:

> What do we have to offer to the currently ill and the about-to-be-ill segments of the population: those whose illnesses have more to do with workplace rather than lifestyle, with the ravages of unemployment rather than defects of character, with the cumulative effects of impoverishment--impoverishment which is becoming increasingly feminized? Shall we say that they should aerobicize, jazzercize, and jog their problems away? Shall we counsel to internalize the locus of control?

Health promotion programs based entirely on efforts to change individual behaviors ignore the structural bases of health problems. In practice, most health promotion programs have targeted middle class and affluent people and have ignored the health problems of the poor.

A second concern is that defining health as the outcome of individual lifestyle raises questions of personal freedom and responsibility. Do I have a right to choose to smoke even if the evidence shows that smoking is harmful to my health? Is smoking merely a dumb choice or is it morally wrong? Vertinsky (1985:73) suggests that health promotion programs may be characterized as "imposing values packed in scientific wrapping". Kreuter, Parsons and McMurry (1982:12-13) suggest that:

> Moralizing is not the same thing as being moral: it is giving in to the temptation to make an issue moral when it really is not, something which can be just as bad as failing to treat an issue as moral when it really is. Moralizing is an attempt to make something more important than it is, to bully people to agreement by moral pressure....Unhealthy lifestyles may be unwise--but they are not necessarily immoral.

Health promotion is not merely the neutral interpretation of biological facts: it is a social policy and practice that requires difficult value judgments. These value judgments belong not to the scientists but to all of us. Pellegrino (1981:373) suggests that we must not confuse technical authority with moral authority:

> But experts have no special prerogatives entitling them to make value judgments for the rest of humankind....Their unique responsibility is to provide valid fact statements and to outline alternatives....With respect to health promotion there are two preeminent fact questions in deciding whether a proposed modification of personal behavior is morally defensible: (a) How good is the causal connection between the suspect behavior and disease? And (b) Does the method proposed to modify deleterious behavior actually do so?

Interestingly, only half of the facts that underlie health promotion decisions are biological. Information is also needed about how to effectively change behavior. These facts must be available in order to make informed decisions, but the final decision about whether and how to influence or mandate behavior is ultimately a moral judgment.

My concern is that physical educators, particularly those interested in exercise and fitness, have tended to reify biological knowledge and to ignore the complex pedagogical and value decisions involved in health promotion. To illustrate, I would like to examine the area of obesity. The reasoning which underlies health promotion programs related to obesity is as follows:

1. Obesity is a health hazard.
2. Any individual can lose weight by eating less or exercising more.
3. Programs to promote weight loss will improve health and therefore will be beneficial to the participants.

I would like to examine each of these assumptions briefly beginning with the first one, obesity is a health hazard. In 1985, a panel of experts selected by the National Institutes of Health concluded that, "The evidence is now overwhelming that obesity, defined as excessive storage of energy in the form of fat, has adverse effects on health and longevity" (NIH, 1985). However, a recent issue of the Harvard Medical School Health Letter (1986) commented that the NIH panel's conclusion is true but that it obscures some important uncertainties. The Health Letter points out that accumulating evidence indicates that the effects of fat on health may differ depending on genetic background, age at which the weight was gained, and where the fat is deposited. While severe obesity is clearly associated with serious health risks, estimating the health hazards of moderate overweight is very complex. The Health Letter notes that the health risks associated with some weight-loss programs and the discrimination and prejudice experienced by overweight people may be more serious than the health problems

associated with moderate overweight. They conclude that the controversy over whether any amount of excess fat is a health liability has yet to be resolved.

The second assumption, that any individual can lose weight, initially seems simple when viewed from a strictly biological perspective. Obesity is the result of a caloric imbalance and can be reversed by consuming fewer calories or expending more or both. However, research on the regulation of body weight indicates that complex metabolic processes may be involved in the development and maintenance of obesity (Lukert, 1982). In addition, a recent study in Denmark showing that adopted children resemble their biologic parents not their adopted parents in body size lends support for the importance of genetic factors in obesity (Stunkard, Sorenson, Hanis, Teasdale, Chakraborty, Schull & Schulsinger, 1986). This research, and the widespread failure of weight loss programs, lead to the conclusion that our assumption that any individual can lose weight may be simplistic and erroneous. Judith Rodin (1982:32) concludes:

> The causes of obesity may be multifactorial. Its onset is determined by a combination of genetic, psychological, and environmental factors, and thus far it has been difficult to disentangle the relative importance of each component. Perhaps this is the reason that for us scientists, as well as for the overweight person, dealing with obesity sometimes feels like such a losing battle.

Examination of the literature indicates that both of the assumptions underlying weight loss programs may ignore the complexity of the scientific

facts. Nevertheless, many would argue that such programs are still justifiable in that they are likely to be beneficial to some and will not harm those who do not benefit. Are such claims accurate? Are any cautions necessary?

What are the possible positive and negative effects of physical education programs promoting weight loss? First, let me begin with the assumption that such programs would provide accurate information about nutrition and exercise which might enable students to defend themselves against the misinformation so prevalent in our society. Second, in contrast to the entrepreneurial enterprises dominating health promotion programs for adults, physical education programs would be available to children from all social classes. Both of these would seem to be benefits. What then are the risks? A major risk is that we will contribute to the frustration and shame of overweight individuals and to their social condemnation by others (Allon, 1982). Another is that overemphasis on body size will reinforce the cult of thinness that has lead to an epidemic of eating disorders among women (Schwartz, Thompson & Johnson, 1982). We must be cautious that our well-intentioned efforts to apply biological knowledge to educational settings do not have deleterious effects.

Let me give you a specific example. On the basis of research relating obesity and health, AAHPERD included a measure of percent body fat in the Health-Related Fitness Test (AAHPERD, 1980). Schools using this test now require that every student be measured for body fatness, usually in a semi-public setting. The assumption seems to be that this assessment is emotionally neutral and will be helpful to the student. My research as

a participant-observer in an exercise class indicates that this may not be the case (Bain, 1985). Overweight students, and in some cases thin students, found the skinfold measures embarassing and threatening. The mandatory nature of the skinfold measures seemed to be an invasion of privacy that was difficult to justify on pedagogical grounds. The data provided by the measures (you are too fat) was not new information nor was it helpful to the overweight students. The point is that seemingly neutral information about skinfolds, obesity and health can be used in ways that socially construct reality for students. Just because we know how to measure skinfolds accurately does not mean that we should choose to do so!

Implications

I have tried to present a case that all knowledge, including scientific knowledge, is socially constructed and therefore not value-free. What are the implications of this position? Does it mean that we should abandon science since it cannot be completely objective? That is not what I am recommending. What I do suggest is that both scientists and those who use scientific knowledge need to understand the nature and limits of science.

One implication is that scientists, not just philosophers and curriculum theorists, need to study the philosophy of science. How many exercise physiologists have read Thomas Kuhn's The Structure of Scientific Revolutions or John Searle's Minds, Brains and Science? Such study may be necessary if we are to prepare researchers who are not narrow technicians but scholars who understand the scientific enterprise.

A second implication is that communication among researchers who have been trained in different scientific communities and paradigms may be an important means for helping individual scholars become aware of the tacit assumptions that underlie their work. A scientific community is like any other culture in that the world view fundamental to the culture tends to remain taken-for-granted and unexamined by members of the group. Cross-cultural communication and research are a necessary part of becoming aware of "cultural blinders". Because of our shared interest in human movement, physical education researchers have a unique opportunity to collaborate across traditional disciplinary boundaries.

The final implication is that all of us must recognize that the interpretation and application of biological knowledge is not the prerogative of the scientist but is a shared professional responsibility. Scientists can provide us with information about the biological aspects of human existence, but the ways in which we use that information to transform our lives and the lives of others is a profound moral question.

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